

AMENDMENTS TO THE CLAIMS

Please replace all prior versions and listings of the claims with the following amended listing of claims:

1. (previously presented) A touchscreen liquid crystal display comprising:

a liquid crystal display including a viewing surface, a liquid crystal area containing liquid crystal located behind the viewing surface, a plurality of spaced apart elongate first electrodes located on a viewing surface side of the liquid crystal area and a plurality of spaced apart elongate second electrodes located on an opposite side of the liquid crystal area, the first and second electrodes overlapping to form an array of liquid crystal pixel elements, at least some of the first electrodes being displaceable towards the second electrodes in response to external pressure applied to the viewing surface;

a control circuit connected to the first and second electrodes for controlling the operation of the liquid crystal display and including: (i) a driver circuit for driving the electrodes for selectively controlling a display state of the pixel elements; and (ii) a measurement circuit for measuring voltages across at least some of the pixel elements and detecting displacement of the at least some of the first electrodes in response to external pressure applied to the viewing surface based on the measured voltages; and

a reference electrode in the liquid crystal display overlapping with the first or second electrodes to form reference pixel elements, the measurement circuit comprising a comparison circuit for comparing the measured voltages to reference voltages measured from the reference pixel elements, wherein the reference pixel elements are located outside of a viewable area of the liquid crystal display a sufficient distance so as not to be substantially affected by external pressure applied to the viewing surface.

2. (cancelled)

3. (previously presented) The display of claim 1 wherein the measurement circuit is configured for determining a location of the external pressure on the viewing surface based on the measured voltages.

4. (previously presented) The display of claim 3 wherein the measurement circuit is configured for determining a relative force of the external pressure on the viewing surface based on the measured voltages.

5. (cancelled)

6. (cancelled)

7. (currently amended) The display of claim 1 wherein the control circuit is configured for operating in a first mode and in a second mode, wherein in the first mode the measurement circuit measures voltages across a subset of the pixel elements until the measured electrical characteristic indicates that external pressure has been applied to the viewing surface, after which the control circuit automatically operates in the second mode, wherein in the second mode the measurement circuit measures voltages across a larger set of the pixel elements and determines the location of the external pressure based thereon.

8. (previously presented) The display of claim 7 wherein a location of the external pressure is determined based on which measured pixel element voltage varies the greatest from a reference value determined in dependence on the reference voltages.

9. (previously presented) The display of claim 1 wherein each of the first and second electrodes is a substantially transparent strip electrode, the first electrodes being arranged substantially parallel to each other, the second electrodes being arranged substantially parallel to each other and substantially orthogonal to the first electrodes for defining the array of pixel

elements, each pixel element being associated with one of the first electrodes and one of the second electrodes, the measuring circuit including a sampling circuit for sampling a voltage across each of the pixel elements and a processing circuit for detecting the displacement and a location thereof based on the sampled voltages, the reference electrode being arranged substantially parallel to either the first or second electrode and substantially orthogonal to the other of the first or second electrode.

10. (previously presented) The display of claim 9 wherein a plurality of scan-able electrodes are included among at least one of the first electrodes and the second electrodes, each scan-able electrode being connected by an associated switch to the driver circuit, the sampling circuit including a controller for individually controlling each switch, the controller being configured for opening the switch associated with a selected one of the scan-able electrodes and causing the voltage across the pixel elements associated with the selected one of the scan-able electrodes to be sampled when the switch associated with the selected one of the scan-able electrodes is open.

11. (original) The display of claim 9 wherein the electrodes are Indium-Tin Oxide (ITO).

12. (currently amended) A method for using a liquid crystal display as a user input, the liquid crystal display having a plurality of first electrodes and a plurality of second electrodes located on opposite sides of a liquid crystal containing area, the first electrodes overlapping with the second electrodes and defining an array of liquid crystal display pixel elements, each pixel element being associated with a unique location where an associated one of the first electrodes overlaps with an associated one of the second electrodes, at least some of the first electrodes being displaceable towards the second electrodes when pressure is applied to a viewing surface of the liquid crystal display, the display having a reference electrode overlapping with the plurality of first electrodes or with the plurality of second electrodes to form

reference pixel elements that are located outside of a viewable area of the liquid crystal display a sufficient distance so as not to be substantially affected by external pressure applied to the viewing surface, the method including:

- (a) selectively driving the first and second electrodes to cause the pixel elements to display an image visible from a viewing side of the viewing surface;

- (b) sampling voltages between the first and second electrodes;

- (c) sampling voltages between the reference electrode and the plurality of first electrodes or second electrodes that the reference electrode overlaps with; and

- (d) determining based on the sampled voltages if any of the first electrodes have been displaced towards the second electrodes.

13. (currently amended) The method of claim 12 wherein the sampling step (b) includes sampling voltages between the first and second electrodes at at least some of the pixel element locations.

14. (original) The method of claim 13 including sampling voltages at a sub-set of pixel element locations until a determination is made that a displacement of first electrodes has occurred and then sampling voltages at a larger set of pixel element locations and determining based on the sampled voltages from the larger set a relative location of the displacement.

15. (original) The method of claim 14 wherein the sub-set of pixel element locations includes pixel element locations associated only with a single line in the array of pixel elements.

16. (original) The method of claim 14 wherein the sub-set of pixel element locations includes a plurality of spaced apart groups of pixel element locations.

17. (original) The method of claim 14 wherein sampling of the sub-set is carried out at a lower rate than sampling of the larger set.

18. (original) The method of claim 14 wherein based on the measured voltages from the sub-set a general location of the displacement is determined, and the larger set is selected to include the general location.

19. (original) The method of claim 13 including determining a relative location of the displacement and a relative magnitude of the force causing the displacement based on the measured voltages and translating the determined location and magnitude into at least one input value for an electronic device associated with the display.

20. (original) The method of claim 13 including determining the center of deflection of the displaced first electrodes by determining, based on the measured voltages, a weighted average of the deflection at a plurality of the pixel locations and determining a centroid of the deflection based on the weighted average.

21. (new) The display of claim 9 wherein the reference electrode forms the reference liquid crystal pixel elements with the first electrodes, and the second electrodes are each individually sampled to acquire the measured voltages, the reference electrode being driven with the same data as the second electrode being sampled.

22. (previously presented) A touchscreen liquid crystal display comprising:
a liquid crystal display including an array of display pixel elements formed by a plurality of parallel first electrodes located on one side of a liquid crystal containing area and overlapping with plurality of parallel second electrodes located on an opposite side of the liquid crystal containing area;
a plurality of reference pixel elements formed by a reference electrode extending parallel to the plurality of first electrodes on the one side of the

liquid crystal containing area and overlapping with the plurality of second electrodes, the reference pixel elements being located outside of a viewable area of the liquid crystal display a sufficient distance so as not to be substantially affected by external pressure applied to the viewable area through a viewing surface of the liquid crystal display;

a driver circuit coupled to the electrodes for driving the electrodes for selectively controlling a display state of the display pixel elements; and

a measurement circuit coupled to the electrodes for scanning at least some of the first electrodes by: measuring display pixel element voltages for at least some of the display pixel elements formed by the first electrode being scanned, and for each display pixel element for which a display pixel element voltage is measured, measuring a corresponding reference pixel element voltage at the reference pixel element that is formed by the reference electrode overlapping with the same second electrode that forms with the first electrode being scanned the display pixel element, the measurement circuit detecting in dependence on the measured display pixel element voltages and the corresponding reference pixel element voltages a relative displacement between at least some of the first electrodes and the second electrodes in response to external pressure applied to the viewing surface.